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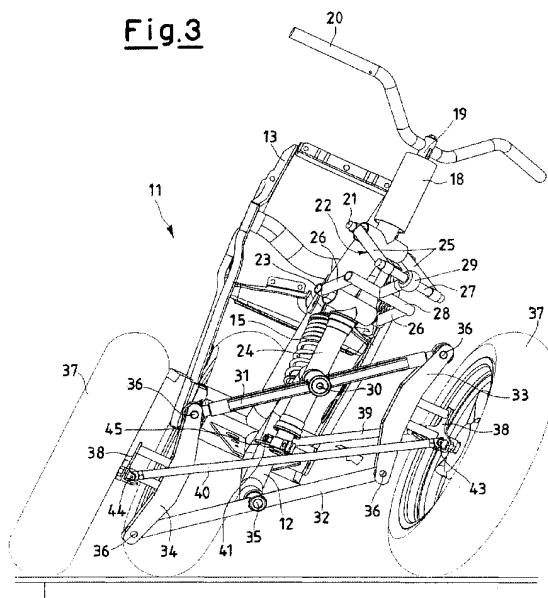
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### (54) **Three-wheeled vehicle with two front steering wheels**

(57) A three-wheeled vehicle (11) with two front steering wheels, comprising a frame, an handlebar, a steering assembly, and front and rear wheels, in which two front wheels (37) are provided supported by a forecarriage (12) and a rear axle (13), the forecarriage (12) and rear axle (13) being articulated together in a hinge region (14), the rear axle (13) pitching in a vertical plane with respect to the forecarriage (12), and there being a shock absorber (15) set between the forecarriage (12) and the rear axle (13), a steering column (19, 19a) connected to the handlebar (20), the steering column (19,

19a) being housed and free to turn in a pair of steering tubes or sleeves (18, 24), one being connected to the rear axle (13) and the other to the forecarriage (12), one end (19a) of the steering column being connected to a pair of articulated rods (39, 40) which are set in succession and which control supports (38) bearing the front wheels (37), the supports (38) being connected to opposite rods (33, 34) of an articulated quadrilateral (31, 32, 33, 34) supported on the remaining two opposite rods (31, 32) by two hinges (30, 35), which are both carried by the forecarriage (12).

**Fig.3**



## Description

[0001] The present invention refers to a three-wheeled vehicle with two front steering wheels.

[0002] At present, there exist numerous types of three-wheeled vehicles, but most of them have one front steering wheel and two rear driving wheels set parallel to one another.

[0003] This type of vehicle enables the combination of the stability of an automobile with the manoeuvrability of a motor cycle. In fact, generally the front part of the vehicle - which is connected to the rear part by shock-absorbing systems set at the rear - is able to perform a rolling motion together with / with respect to the rear part, so that the vehicle can be driven exactly like a two-wheeled vehicle (possibility for the driver to incline his/her body), whilst still maintaining to a large extent the intrinsic stability of a four-wheeled vehicle).

[0004] In conclusion, these vehicles enable the user to get about easily and comfortably in town traffic thanks to their limited width, and moreover the driver does not have to put his feet down when he stops the vehicle, also thanks to particular known devices, for example mechanical and/or hydraulic ones, for blocking any rolling motion of the vehicle itself. Furthermore, such vehicles provide greater safety and protection in the presence of bad weather.

[0005] In addition, precisely on account of their more stable structure, such vehicles can be covered more easily, for example to form a bodied vehicle which provides shelter from bad weather, as mentioned above.

[0006] On the other hand, these vehicles present certain problems and drawbacks, such as:

- non-precise drivability, in the sense of determining the path of the vehicle, owing to the presence of a single wheel for directing the vehicle, with possible slipping and problematical manoeuvres when braking/accelerating, etc.;
- the need for the adoption of a differential system for the rear wheels; and
- the limitation involved in adopting rear-wheel drive systems on account of the small space available, and consequent difficulty of inserting also a passenger seat and/or a support for luggage, and/or luggage alone.

[0007] The main purpose of the present invention is to solve totally, or at least to a fair extent, the problems and drawbacks referred to above, at the same time making a three-wheeled vehicle.

[0008] Another purpose is to provide a three-wheeled vehicle which enables the greatest possible adherence to the road, albeit in the presence of a capacity for inclination that favours drivability like that of a motor vehicle.

[0009] A further purpose is to provide a three-wheeled vehicle that can be covered, for example with a vehicle body.

[0010] Not the last purpose is to make available an economical three-wheeled vehicle with space for a passenger and for luggage, which is safe and which provides a certain comfort.

[0011] Yet another purpose is to provide a three-wheeled vehicle that does not have any differential, with consequent smaller encumbrance and more space available for possible additional members.

[0012] The above purposes according to the present invention are achieved by providing a three-wheeled vehicle with two front steering wheels, as specified in Claim 1.

[0013] Further characteristics and advantages of the present invention emerge from the ensuing dependent claims.

[0014] The characteristics and advantages of a three-wheeled vehicle with two front steering wheels according to the present invention will emerge more clearly evident from the ensuing description, which is provided purely to give an explanatory and non-limiting example, with reference to the attached schematic drawings, in which:

Figure 1 is a perspective view of a three-wheeled vehicle with two front steering wheels according to the present invention, in which connection to the rear wheel is shown only partially;

Figure 2 is a view from underneath of the front part of the vehicle illustrated in Figure 1;

Figure 3 is a front perspective view of the vehicle illustrated in Figure 1, with a slight steering inclination;

Figure 4 is an enlarged detail of a first half of the front part of the vehicle illustrated in Figure 1; and

Figure 5 is an enlarged detail of a second half of the front part of the vehicle illustrated in Figure 1.

[0015] With reference to the figures, a three-wheeled vehicle with two front steering wheels according to the present invention is designated, as a whole, by the reference number 11.

[0016] The vehicle 11 basically comprises a frame consisting of a forecarriage 12 and a rear axle 13, articulated together in a hinge region 14. In addition, the rear axle can pitch in a vertical plane with respect to the forecarriage 12, i.e., with respect to the hinge region or point 14, thanks to the interposition of a shock absorber 15. The said shock absorber 15 is hinged at its opposite ends to the rear axle 13 in 16 and to the forecarriage 12 in 17.

[0017] The forecarriage 12 presents a widened-U shape in its longitudinal direction, the front end of the forecarriage 12 terminating in a top steering tube or sleeve 18, in which a steering column 19 having at its top end an handlebar 20 is housed. At a bottom end, the steering column 19 carries, hinged in 21, a compound lever, designated as a whole by 22, which, when the vehicle is advancing straight forward, is transverse to the

frame. The compound lever 22 is in turn hinged in 23 at its bottom end to a further portion 19a of the steering column, the said portion 19a being inserted in a bottom steering tube or sleeve 24 which is fixedly connected to the forecarriage 12.

**[0018]** The compound lever 22 is made up of a pair of double levers 25 and 26, the former of which, 25, terminates with a shaft or pin 27, and the latter, 26, is rigidly connected to a lever 28 shaped like a reversed T, carrying at one central free end a support 29 designed to accept the shaft 27 in such a way that the shaft 27 can rotate. In this way, the two pairs of levers 25 and 26 are articulated together.

**[0019]** The bottom steering tube or sleeve 24, which, as has been said, is connected fixedly to the forecarriage 12, carries a first rod 31 ~ which is transverse to the entire frame and forms part of an articulated quadrilateral belonging to the steering assembly ~fixed so that it is pivoted centrally in a cylindrical hinge 30.

**[0020]** A second rod 32, opposite to the first rod 31 in the aforesaid articulated quadrilateral, which is completed by two further side rods 33 and 34, set opposite to one another, is pivoted centrally in a second cylindrical hinge 35 at the bottom free end of the forecarriage 12.

**[0021]** The four rods 31, 32, 33 and 34 are, of course, connected at their ends by articulated joints 36 which complete the above-mentioned articulated quadrilateral.

**[0022]** The two side rods 33 and 34 set opposite to one another support two wheels 37 by means of articulated joints of a cylindrical type, which are located on supports 38. The orientation of these articulated joints, and consequently of the wheels 37, is determined by two rigid rods 39 and 40.

**[0023]** The first rod 39, which is shorter, is pivoted on one side in 41, to the bottom end 19a of the steering column 19 by means of a lever arm 45, and on the other side in 42, to a first of the two supports 38 bearing a wheel 37. The second rod 40 is set between the two supports 38, which face one another, by means of pivoting points 43 and 44 to the said supports 38.

**[0024]** In this way, a correct relation of the various parts of the steering assembly is obtained.

**[0025]** The movement of steering imposed by the driver of the three-wheeled vehicle by means of the handlebar 20 is transmitted by the steering column 19, 19a, through the top steering tube or sleeve 18, which belongs to the rear axle 13, and through the compound lever 22, to the bottom steering tube or sleeve 24, which belongs to the forecarriage 12.

**[0026]** In this way, the rear axle 13 can pitch in a vertical plane with respect to the forecarriage 12, both on account of the hinge point 14 and on account of the interposition of the shock absorber 15

**[0027]** The steering motion is then transmitted from the the bottom end of steering column 19a, passing through the steering tube or sleeve 24, to the front wheels 37 by means of the lever arm 45 and the two

levers 39 and 40.

**[0028]** The entire steering assembly (articulated quadrilateral and levers with articulated joints) is thus free to roll about the cylindrical hinges 30 and 35 according to the position/inclination of the driver for any steering angle.

**[0029]** With the splitting of the rear axle from the forecarriage with the interposition of a shock-absorbing system 15, with the splitting of the front steering tube or sleeve 18, 24, and with a steering system having the steering motion independent of the inclination of the front wheels 37, extreme driving precision and safety is obtained. In addition, there are also other advantages, such as a vehicle that can be equipped with a body, elimination of the differential, and the possibility of powering the vehicle with various types of engines, etc.

**[0030]** A three-wheeled vehicle according to the invention is thus equipped with two parallel front steering/inclinable wheels which impart direction, and a central rear driving wheel which can be inclined with the vehicle. Such a vehicle can thus be driven like a motor cycle: a front part, which is inclinable (rolling motion) together with the rear.

**[0031]** Advantageously, since the front steering assembly (articulated quadrilateral) can roll with respect to the rear part, the front wheels can in turn be inclined like the rear wheel, at the same time, however, always remaining in contact with the ground, with a greater adherence, to the advantage of drivability of the vehicle itself.

**[0032]** Furthermore, the said vehicle is suitable for being covered (bodied), given its limited and compact size.

**[0033]** In addition, the forecarriage of the said vehicle can oscillate in a vertical plane (pitching motion) with respect to the rear axle by being hinged to the latter and having at the front a shock absorber which connects the two parts. In this solution, the steering tube/sleeve is split into two parts which are not aligned with one another (one belonging to the rear axle, together with the handlebars, and the other to the forecarriage, together with the steering system), so that; since the two parts move with respect to one another, an appropriate compound lever for control/transmission between the two parts of the steering sleeve/tube is necessary.

**[0034]** In brief, with a three-wheeled vehicle according to the invention the following advantages are achieved:

more precise, safer and more manoeuvrable drivability (two steering and inclinable wheels which impart direction);  
availability of a more comfortable vehicle;  
greater economy (elimination of the differential);  
freedom from the known types of rear-wheel drive, thus providing a lot more space at the rear owing to the absence of the differential system; and  
availability of more space at the rear (for possible passenger, luggage support, luggage, etc.).

## Claims

1. A three-wheeled vehicle (11) with two front steering wheels, comprising a frame, an handlebar, a steering assembly, and front and rear wheels, **characterized in that** it is provided with a pair of front wheels (37) supported by a forecarriage (12) and a rear axle (13), said forecarriage (12) and rear axle (13) being articulated together in a hinge region (14), said rear axle (13) pitching in a vertical plane with respect to said forecarriage (12), there being a shock absorber (15) set between said forecarriage (12) and said rear axle (13), a steering column (19, 19a) connected to the handlebar (20), the steering column (19, 19a) being housed and free to turn in a pair of steering tubes or sleeves (18, 24), one being connected to said rear axle (13) and the other to said forecarriage (12), one end (19a) of said steering column being connected to a pair of articulated rods (39, 40) which are set in succession and which control supports (38) bearing said front wheels (37), said supports (38) being connected to opposite rods (33, 34) of an articulated quadrilateral (31, 32, 33, 34) supported on the remaining two opposite rods (31, 32) by two hinges (30, 35), which are both carried by the forecarriage (12).
 

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2. A three-wheeled vehicle (11) with two front steering wheels according to Claim 1, **characterized in that** said steering column is divided into two parts (19, 19a) connected together by an articulated intermediate compound lever (22), one first part (19) being set in a first, top, steering tube or sleeve (18) which is integral with said rear axle (13), and one second part (19a) being set in a second, bottom, steering tube or sleeve (24) which is integral with said forecarriage (12).
 

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3. A three-wheeled vehicle (11) with two front steering wheels according to Claim 2, **characterized in that** said intermediate compound lever (22) is articulated at its ends (in 21 and 23) and comprises a pair of double levers (25, 26), the former of which (25) terminates with a shaft or pin (27), and the latter (26) is rigidly connected to a lever (28) shaped like a reversed T, carrying at one central free end a support (29) designed to accept said shaft (27) so that it can turn.
 

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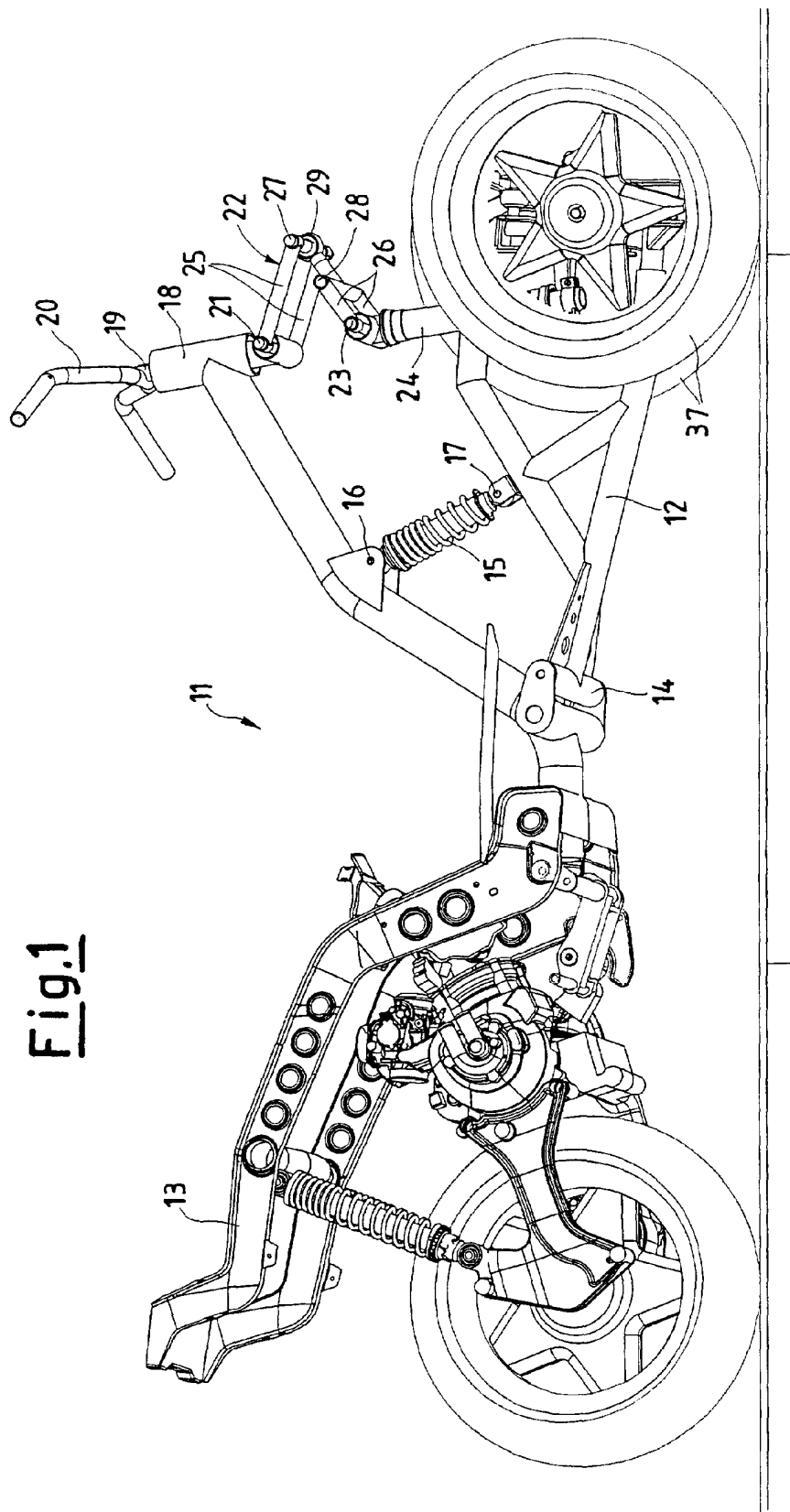
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4. A three-wheeled vehicle (11) with two front steering wheels according to Claim 1, **characterized in that** said two hinges (30, 35), which are both carried by said forecarriage (12), are cylindrical hinges.
 

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5. A three-wheeled vehicle (11) with two front steering wheels according to Claim 1, **characterized in that** said pair of rods (39, 40) is made up of a first rod (39) pivoted at one end (in 41) to a lever (45) con-
 

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nected to the bottom end (19a) of said steering column, and at the other end (in 42) to a first of said supports (38), and of a second rod (40) which is set between said two supports (38) which face one another and is pivoted to them (in 43, 44).

**Fig.1**



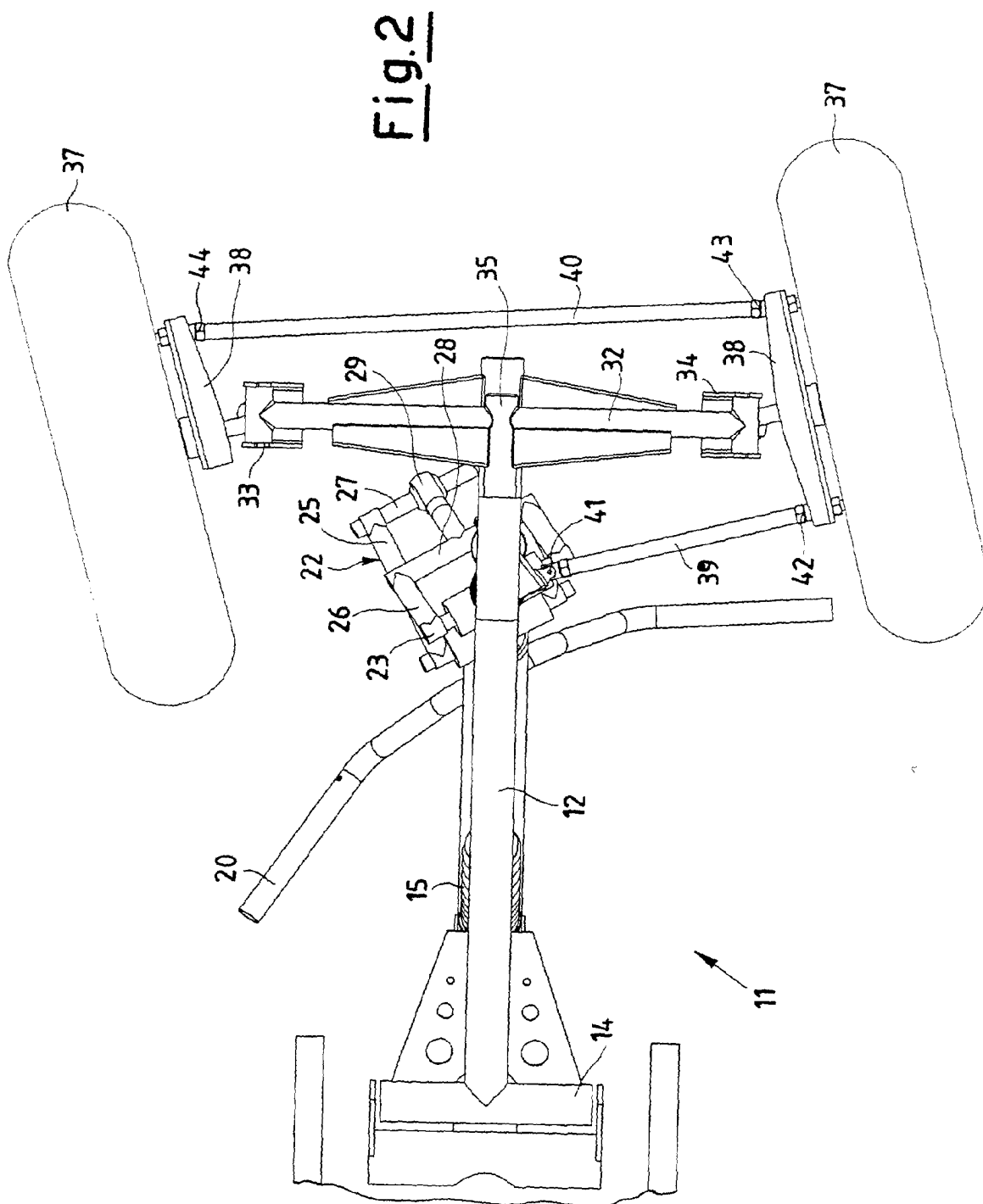
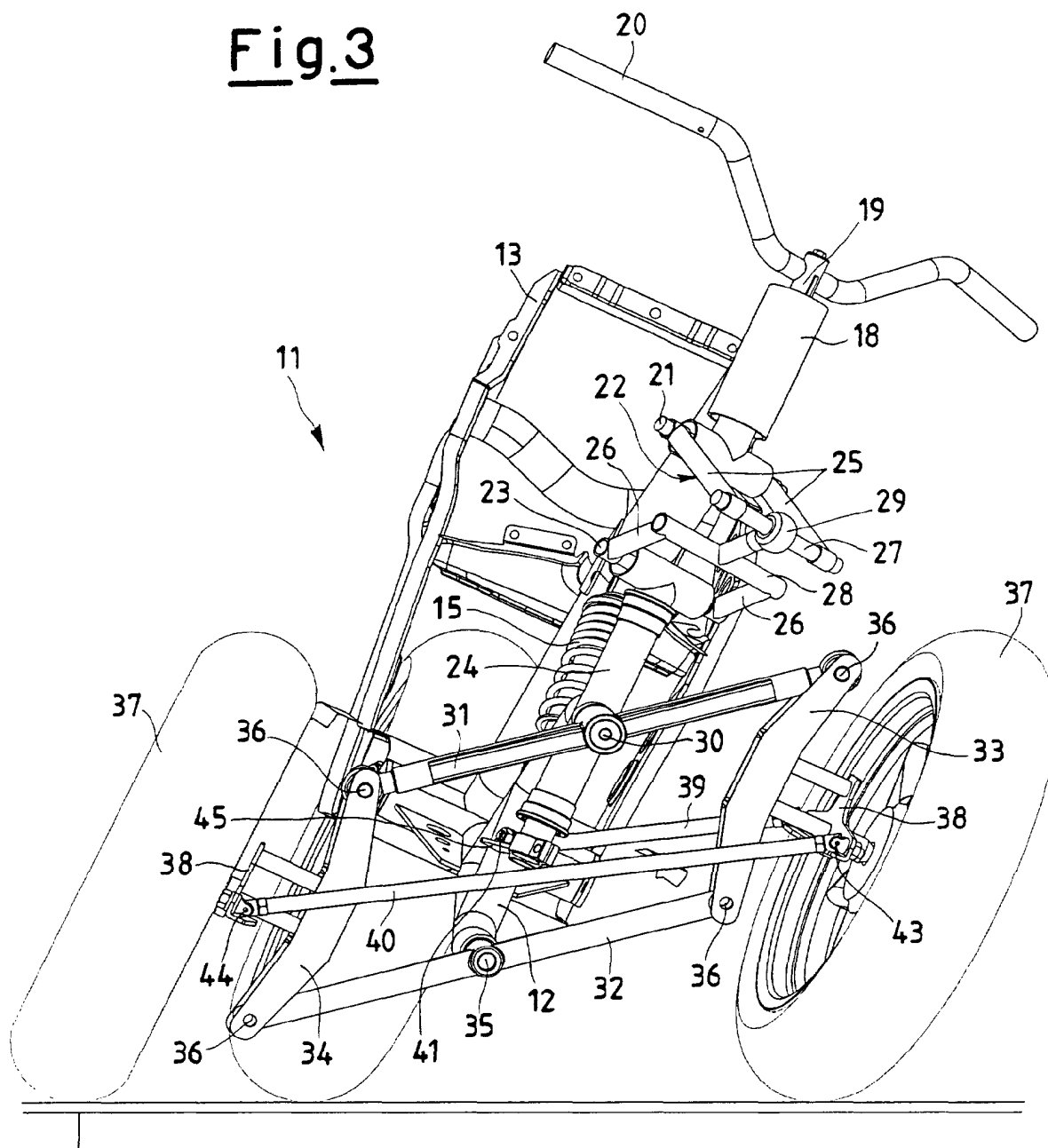


Fig.3



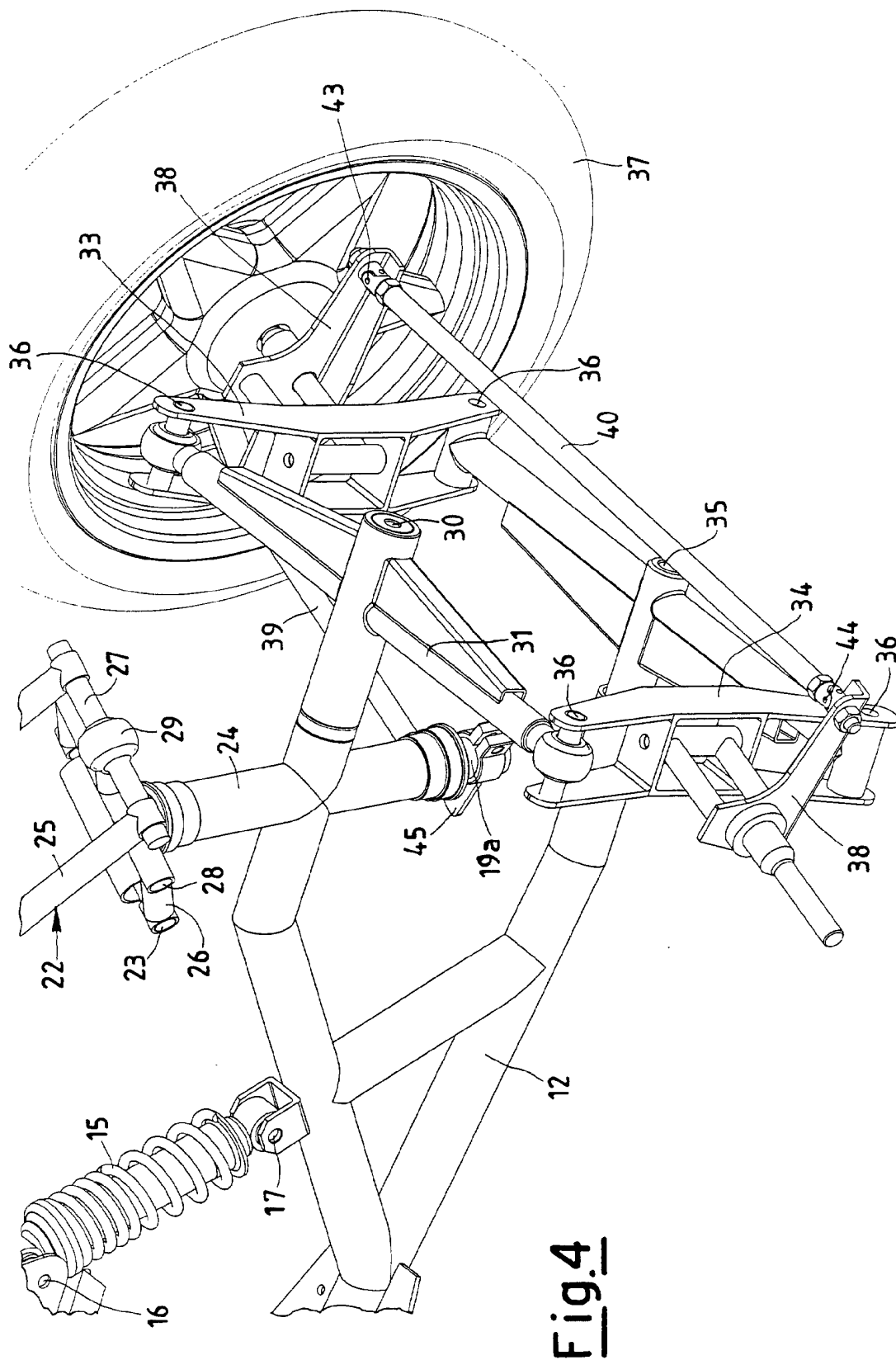
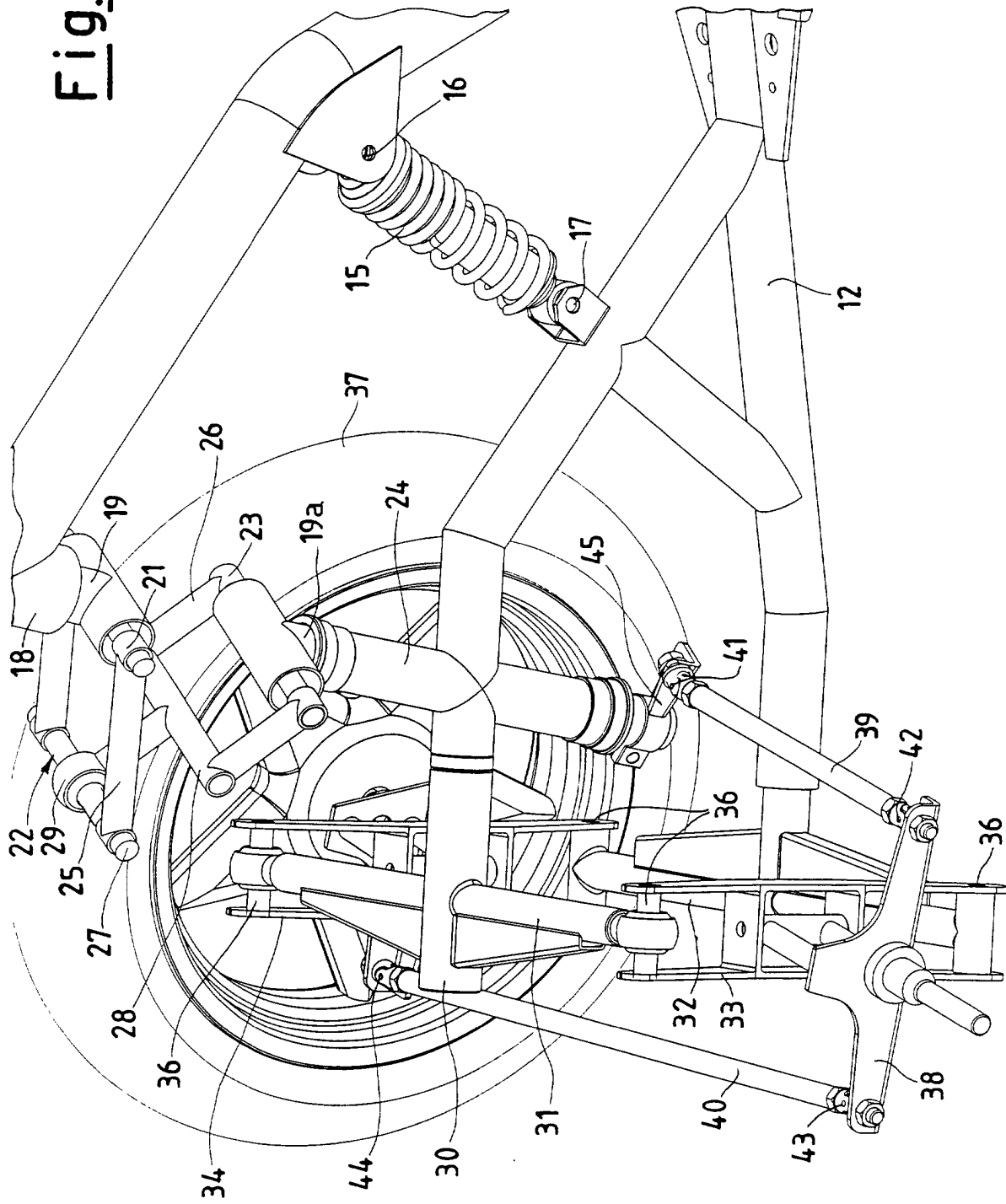




Fig.5



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